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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1093

BOMBS AND ASSOCIATED COMPONENTS

3rd Partial Report

TESTS OF FIRE BOMB MK 77 MOD 0
MODIFIED TO 75 GALLON CAPACITY

FINAL Report

Copy No. _____

Task

Assignment NP6-Re3c-321-1-53

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NPG REPORT NO. 1093

Tests of Fire Bomb Mk 77 Mod O Modified to 75 gallon Capacity

PART A

SYNOPSIS

1. This is the final report on catapult and arrested landing and Douglas bomb ejector tests of the Mk 77 Mod O Fire Bomb modified to 75 gallon capacity. The purpose of this test was to determine the maximum accelerations in the fore and aft and side directions this bomb will withstand without causing deformation that would be detrimental to the operation of the bomb and to determine whether the bomb will withstand the forces applied by Douglas bomb ejector without deformation that would be detrimental to the operation of the bomb.

2. The Mk 77 Mod O Fire Bomb modified to 75 gallon capacity withstood 15.1 g's acceleration in the fore and aft direction and 9.7 g's sideways without deformation. This bomb satisfactorily withstood the Douglas bomb ejector forces with only minor deformation.

3. It is concluded that:

a. The Mk 77 Mod O Fire Bomb modified to 75 gallon capacity will withstand an acceleration of 15.1 g's in the fore and aft direction and 9.7 g's sideways without suffering deformation which would be detrimental to the operation of the bomb.

b. The modified Mk 77 Mod O Fire Bomb is suitable for use with the Douglas bomb ejector.

c. The modified Mk 77 Mod O Fire Bomb should be suitable for most operational catapult take-offs and arrested landings although it does not meet the general acceleration requirements for all externally carried aircraft stores as listed in reference (c).

4. It is recommended that a seal be developed for closing the end bulkheads which is more effective than the shaft seal used on the samples tested.

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PART B

INTRODUCTION

1. AUTHORITY:

These tests were authorized by reference (a) and conducted in accordance with reference (b).

2. REFERENCES:

- a. BUORD Conf ltr NP9-Re3c-BEK:mp Ser 42777 of 29 Jul 1952
- b. BUORD Rest ltr Re3c-RMN;gg F41-6 of 25 Nov 1952
- c. BUORD Rest ltr NP9-Re3c-LME:edb of 31 Aug 1951

3. BACKGROUND:

A requirement exists for a Fire Bomb, suitable for suspension on the Aero 14A bomb rack. The Mk 77 Mod O Fire Bomb has been modified to 75 gallon capacity for this purpose. Reference (b) was written to accomplish testing of this modified fire bomb.

4. OBJECT OF TEST:

The object of this test was to determine the maximum accelerations which this modified bomb will withstand in the fore and aft and side directions without causing deformation which would be detrimental to the operation of the bomb. It was further desired to determine whether the bomb will withstand the forces applied by the Douglas bomb ejector without deformation that would be detrimental to the operation of the bomb.

5. PERIOD OF TEST:

- | | |
|--------------------------------------|-------------------------------------|
| a. Date of Project Letter | 25 November 1952 |
| b. Dates Necessary Material Received | 4 December 1952
16 December 1952 |
| c. Date Commenced Test | 9 December 1952 |
| d. Date Test Completed | 18 December 1952 |

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Tests of Fire Bomb Mk 77 Mod 0 Modified to 75 gallon Capacity

PART C

DETAILS OF TEST

6. DESCRIPTION OF ITEMS UNDER TEST:

The Mk 77 Mod 0 Fire Bomb was modified to 75 gallons capacity by shortening the center section to 23 inches. The front and rear sections were then welded to the center section. This eliminated the circumferential gasketed seams and eliminated reliance on the longitudinal tie-rod through the center of the bomb for holding the three (3) sections together and providing sealing pressure. The resulting welded bomb derives its strength from its continuous, stressed skin construction. The modified bomb is approximately 90 inches long and remains 19 inches in diameter. The bombs were water filled for the catapult and arrested landing and Douglas bomb ejector tests. Inert M23 igniters and arming wires were installed for the catapult and arrested landing tests.

7. DESCRIPTION OF TEST EQUIPMENT:

a. The acceleration tests were conducted on the Catapult and Arrested Landing Facility of the Laboratory Services Division of the Aviation Ordnance Department. This consists of a car traveling on a track launched by a catapult Type P, Mk 6 Mod 0, and stopped by an arresting gear unit Mk 4.

b. The bomb ejector test was conducted on the Douglas Bomb Ejector Facility. This consists of a Douglas bomb ejector mounted on the bomb ejector tower. A Mk 1 Mod 2 Bomb Ejector Cartridge was used with the modified Mk 77 Mod 0 Fire Bomb.

8. PROCEDURE:

a. Acceleration Tests:

The modified Mk 77 Mod 0 Fire Bombs were filled with water and two (2) inert M23 igniters and arming wires installed. The bombs were mounted on the catapult car and sway braced to simulate operational use. The bomb was accelerated with the nose forward for fore and aft loading and with the longitudinal axis perpendicular to the motion of the car for side loading. Appendix (A) lists the complete schedule of accelerations to which the fire bombs were subjected.

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b. Douglas Bomb Ejector Test:

The Douglas bomb ejector was mounted on the bomb ejector tower. The modified Mk 77 Mod O Fire Bomb was filled with water and hoisted into position and latched on the bomb ejector with the nose down. A 35mm Mitchell motion picture camera was set up so that photographs could be made of the fire bomb in the interval between the firing of the ejector and the impact of the bomb with the ground. A Mk 1 Mod 2 Bomb Ejector Cartridge was loaded in the ejector and the ejector was fired after starting camera operation to observe the complete fall of the bomb.

9. RESULTS AND DISCUSSION:

All accelerations listed are the equivalent values for this fire bomb filled with napalm mixture.

a. There was a slight water spray from the filling caps of the modified Mk 77 Mod O Fire Bomb at 15.1 g's when the bomb was catapulted with the nose forward. The fire bomb was considered satisfactory for this acceleration, which was the maximum attainable, in the fore and aft direction.

b. There was a slight water leakage from the seal between the through rod and the end bulkheads after the modified Mk 77 Mod O Fire Bomb was catapulted at 9.7 g's sideways. The bomb was still considered satisfactory.

c. The welded seam between the forward and center sections of the modified Mk 77 Mod O Fire Bomb split when the bomb was catapulted at 11.4 g's sideways.

d. In all accelerations of the modified Mk 77 Mod O Fire Bomb in both the fore and aft and side directions, no arming or displacement of the igniters or displacement of the arming wires occurred.

e. The modified Mk 77 Mod O Fire Bomb was no more than superficially damaged by the bomb ejector foot. This superficial damage is shown in Figure 1.

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Tests of Fire Bomb Mk 77 Mod O Modified to 75 gallon Capacity

PART D

CONCLUSIONS

10. It is concluded that:

a. The Mk 77 Mod O Fire Bomb modified to 75 gallon capacity will withstand an acceleration of 15.1 g's in the fore and aft direction and 9.7 g's sideways without suffering deformation which would be detrimental to the operation of the bomb.

b. The modified Mk 77 Mod O Fire Bomb is suitable for use with the Douglas bomb ejector.

c. The modified Mk 77 Mod O Fire Bomb should be suitable for most operational catapult take-offs and arrested landings although it does not meet the general acceleration requirements for all externally carried aircraft stores as listed in reference (c).

PART E

RECOMMENDATIONS

11. It is recommended that a seal be developed for closing the end bulkheads which is more effective than the shaft seal used on the unmodified Mk 77 Mod O Fire Bomb and the samples tested. Presumably this bulkhead could be made solid since the need for the central through rod does not exist. It should be noted that the advantageous nesting ratio of the Mk 77 Mod O Fire Bomb has been lost.

PART F

DISPOSITION OF MATERIAL

12. The two (2) damaged fire bombs were returned to the Ammunition Division of the Armament Department for disposal as scrap. Instructions are requested for the disposition of the third, undamaged fire bomb.

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Tests of Fire Bomb Mk 77 Mod 0 Modified to 75 gallon Capacity

The tests upon which this report is based were conducted by:

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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Fifty-third Partial Report
on
Bombs and Associated Components

Final Report
on
Tests of Fire Bomb Mk 77 Mod 0
Modified to 75 gallon Capacity

Project No.: NPG-Re3c-321-1-53
No. of Pages: 7

Date:

FEB 26 1953

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Tests of Fire Bomb Mk 77 Mod O Modified to 75 gallon Capacity

TABLE I

Tabulated Test Data

Acceleration Tests of Fire Bomb Mk 77 Mod O
Modified to 75 gallon Capacity

<u>Date</u>	<u>Direction</u>	<u>Acceleration in g's*</u>	<u>Results</u>
12-9-52	Fore & Aft	6.1	No Change
12-9-52	Fore & Aft	7.6	No Change
12-9-52	Fore & Aft	9.0	No Change
12-9-52	Fore & Aft	10.4	Slight water spray from filling caps. O.K.
12-9-52	Fore & Aft	11.9	Some water spray from filling caps. O.K.
12-18-52	Side	3.0	No Change
12-18-52	Side	4.5	No Change
12-18-52	Side	6.1	No Change
12-18-52	Side	7.6	Water leak from thru rod seals. O.K.
12-18-52	Side	9.0	Welded seam split at bottom.

* These accelerations may be multiplied by 1.27 to give equivalent values for the bomb filled with napalm mixture.

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APPENDIX A

NP9-52121

Mk 77 Mod 0

10 December 1952

fire bomb modified to 75 gallon capacity after firing from Douglas bomb ejector. Note lack of deformation of all parts.

Figure 1

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Tests of Fire Bomb Mk 77 Mod 0 Modified to 75 gallon Capacity

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